Editorial

Moderation

CONVERSATION at any meeting of surgeons, whether local or national, reveals that a new interest has come to the forefront of American Surgery: the widespread use of buffered or balanced salt solutions.

At the seminars, courses and forums one hears several examples of man's ability to tolerate huge volumes of balanced salt solutions intravenously. That such would be given seems remarkable in view of the admonitions of only 25 years ago, that salt solutions were undesirable during and after the operative period, unless there was external loss or traumatic edema.

So let's stop and inquire—what is the evidence? But first, what are recommendations?

The recommendation has been made by some that salt solutions should be used to "fill" the vascular volume and then "maintain" it by flooding the interstitial fluid volume. These advocates also advanced the idea that patients should be given four times the anticipated blood loss before it occurs. An example here would be the administration of 7,000 ml. of balanced salt solution in a 3-hour combined abdominal perineal resection. For an anticipated loss of half the blood volume, this would be twice the starting volume or 10,000 ml. at rates up to 3,300 ml./hr.

Now, precisely what evidence can be produced to support these recommendations?

First, it is stated that because "sodium is pressor," a very high total body sodium will support blood pressure. Certainly it is true that sodium ion, in general, is pressor; hypertensive patients have elevated values for total exchangeable sodium, a lowering in the volume of body fluids available for the solution of sodium leads to a fall in plasma volume, reduced blood volume, and a fall in blood pressure, while a lowering of the extracellular sodium concentration is often associated with poor cardiovascular function. Unfortunately, one cannot progress from these facts to the concept that a huge excess of total body sodium will always result in good cardiovascular function. Conditions associated with the largest body sodium contents are congestive heart failure, liver failure, starvation edema, and chronic renal failure. These are not all associated with superb circulation.

There is likewise no question that huge volumes of saline solution will restore and support the blood volume after loss of whole blood. It was shown about 30 years ago that one can flood the interstitial fluid of an animal so completely that the plasma volume will increase to values that are even far above normal. More recently evidence has been brought forward to show that after blood loss a disproportionate amount of an infused salt solution remains in the vascular phase for about 90 minutes after blood loss—but with marked hemodilution as evidenced by lowering of the hematocrit and protein concentration—before it is then dispersed into the interstitial fluid and ultimately disposed by the renal route.

Each investigator who rediscovers the special osmotic effects of sodium in holding water in the extracellular fluid and plasma volume also rediscovers that expansion of the extracellular fluid volume will release the kidney from the restrictive tubular influences attendant upon volume

reduction and will support glomerular filtration rate.

Second, it is stated that balanced salt solution is preferable to other types of solution for making up decreases in effective interstitial fluid volume. We would agree that for the purpose of treatment in extensive trauma, intestinal obstruction, diarrhea, or burns, balanced salt solution is far preferable to pure sodium chloride (with its threat of hyperchloremia), dextrose in water (with its threat of hyponatremia), concentrated crystalloids such as mannitol or sucrose (with their transient further reduction in interstitial fluid volume) or whole blood alone (with its attendant further increase in hematocrit and viscosity).

Third, there is evidence from data based on radiosulphate dilution curves to show that the interstitial fluid volume is disproportionately reduced in hypovolemic shock. It should be pointed out that these data apply to hypotensive hypovolemic shock and do not occur when simple blood loss alone without shock is sustained. On this particular point the two authors of this editorial might find some room for difference of opinion, were it not for our mutual respect for the interpretive difficulties in isotope dilution work. Supportive evidence indicates that this disproportionate reduction may be an intracellular swelling in response to the low flow state and will, therefore, have quantitative limits. Despite minor differences in interpretation, we are enthusiastically agreed that no conceivable interpretation of these data would justify the use of such excessive volumes of balanced salt solution for early replacement in hemorrhage. Neither is the use of saline solutions meant to be a substitute for whole blood. Whole blood is still the primary therapy for blood loss shock.

Administration of balanced salt solution during a surgical procedure is intended to replace extracellular fluid which is functionally sequestered as interstitial edema much as in a patient with extensive trauma or burns, although to a far lesser degree. This replacement is now quantifiable and becomes significant, within limits, only with major surgical trauma. Consequently, replacement during operation should be carefully estimated and limited unless there is additional excessive measurable extracellular fluid loss, such as from the bowel, etc. Blood should still be replaced during major operative surgery as it is lost. The use of balanced salt solutions appears to be a physiological adjunct to surgical trauma; not a substitute for blood.

The tendency of physicians and surgeons to go all out for new ideas, is noteworthy. Possibly it may even be praiseworthy. Certainly it is better than stodgy conservatism. But it should be tempered with caution in adopting simple rules of thumb that prevent accuracy in estimates and replacement.

Instead of any such rule of thumb, the surgeon should carry on with his established habits of careful assessment of the patient's situation, the losses incurred, and the physiologic needs in replacement. The objective of care is restoration to normal physiology and normal function of organs, with a normal blood volume, functional body water and electrolytes. This can never be accomplished by inundation.

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